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EP 0073127 A2

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(54) A guide device for a drill

(57) A drill guide device (11) has a workpiece clamp (13) comprising two jaws (33, 37) connected respectively to elongate primary guides (29, 30) and an elongate secondary guide member (36). A drill carrier body (15) is slidable along the primary guides (29, 30) under the control of a drill feed mechanism (14) primarily comprising a pantograph linkage (43) connected between the drill carrier body (15) and the secondary guide member (36) in such a way that application of a drill advancing force to the feed control mechanism (14) automatically causes closure of the workpiece clamping jaws (33, 37).

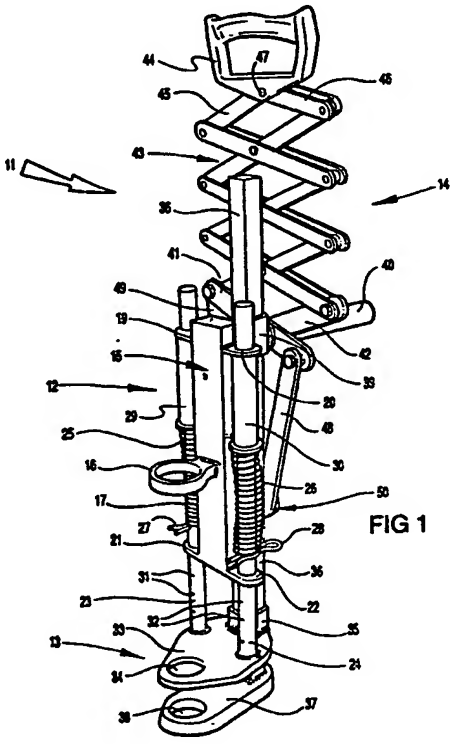

FIG 1

At least one drawing originally filed was informal and the print reproduced here is taken from a later filed formal copy.

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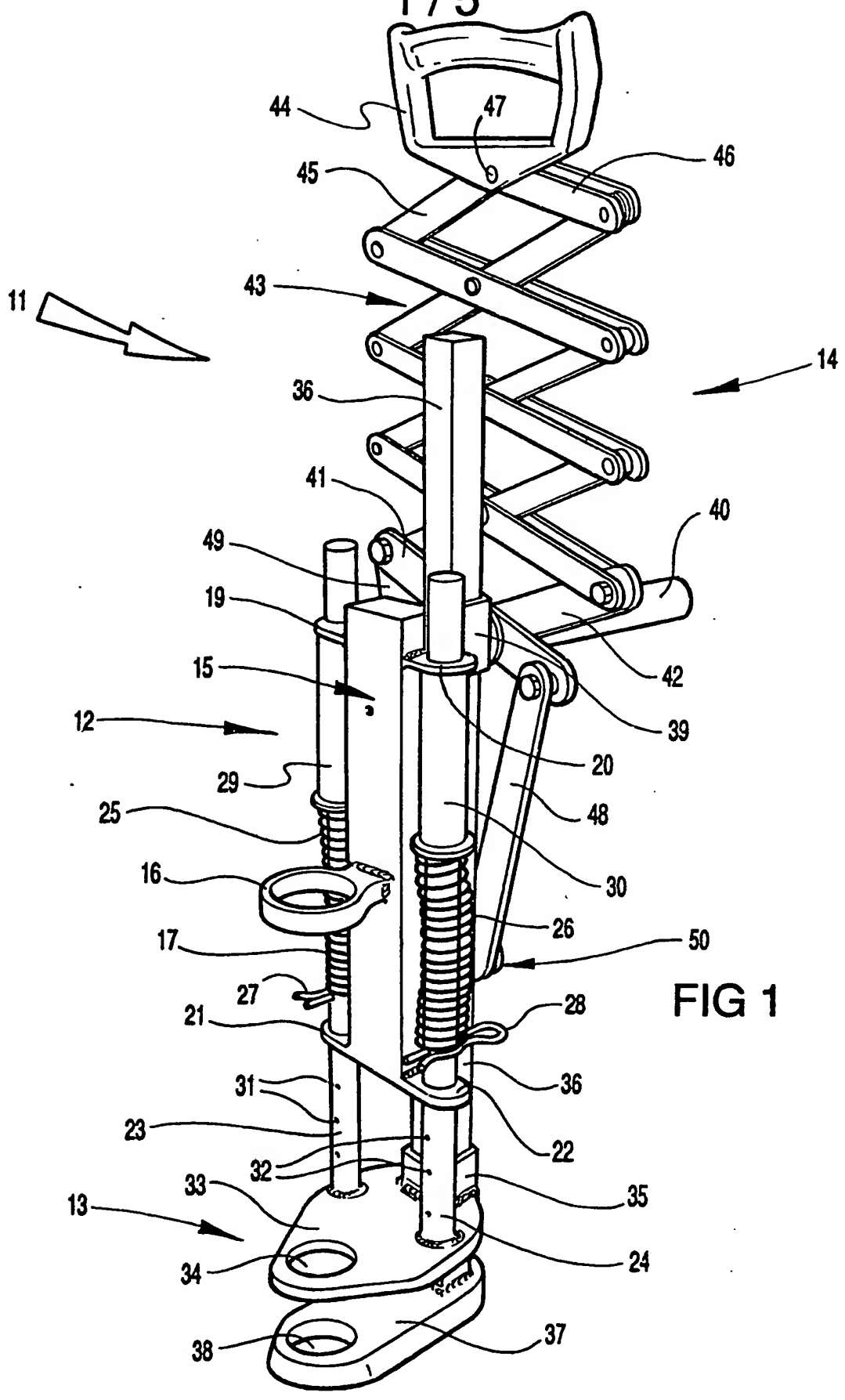
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FIG 1

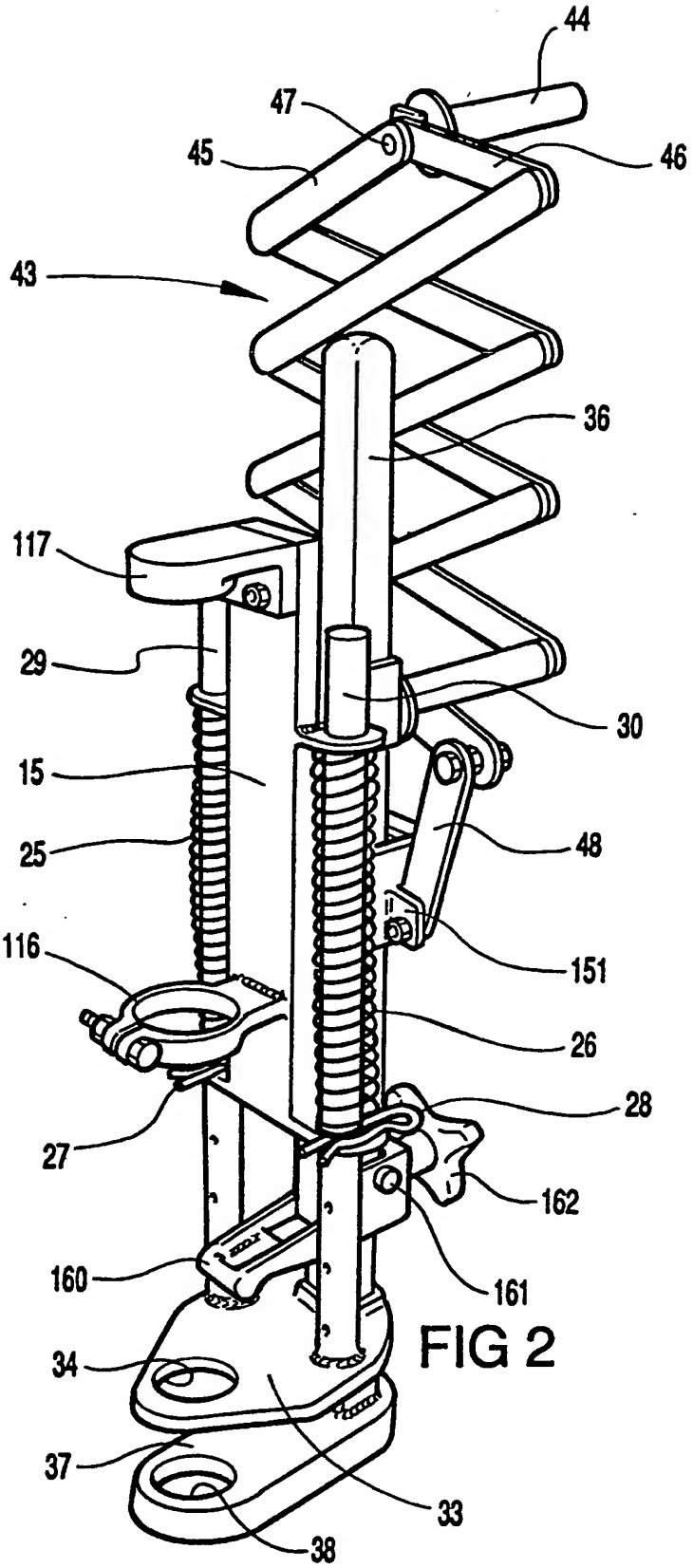
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FIG 2

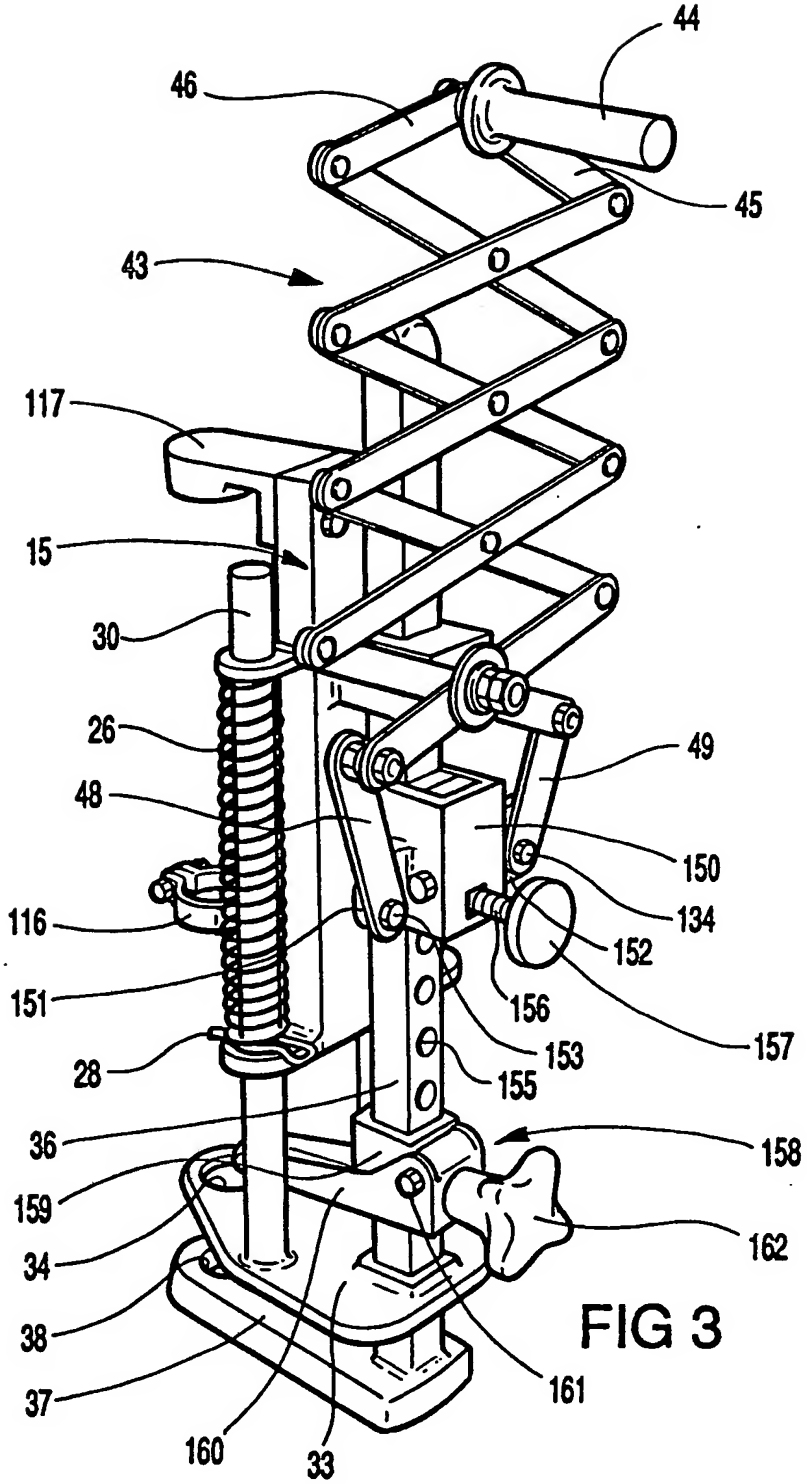
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FIG 3

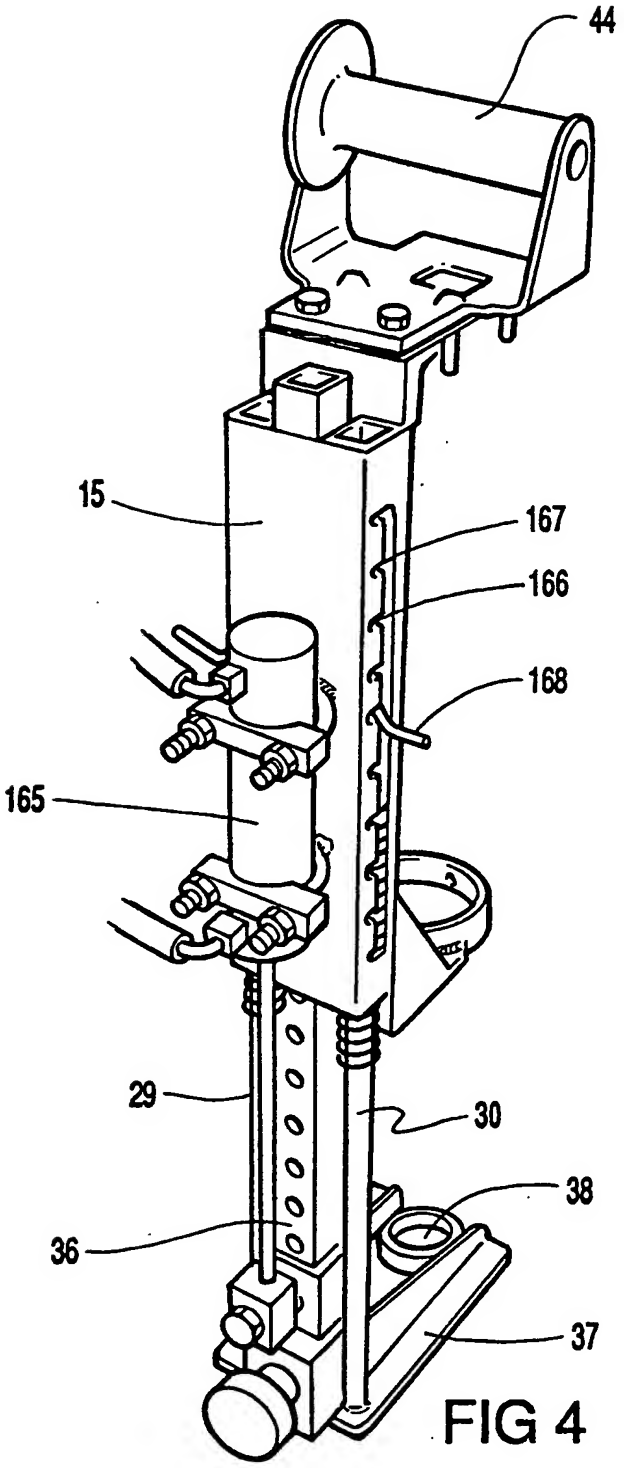

FIG 4

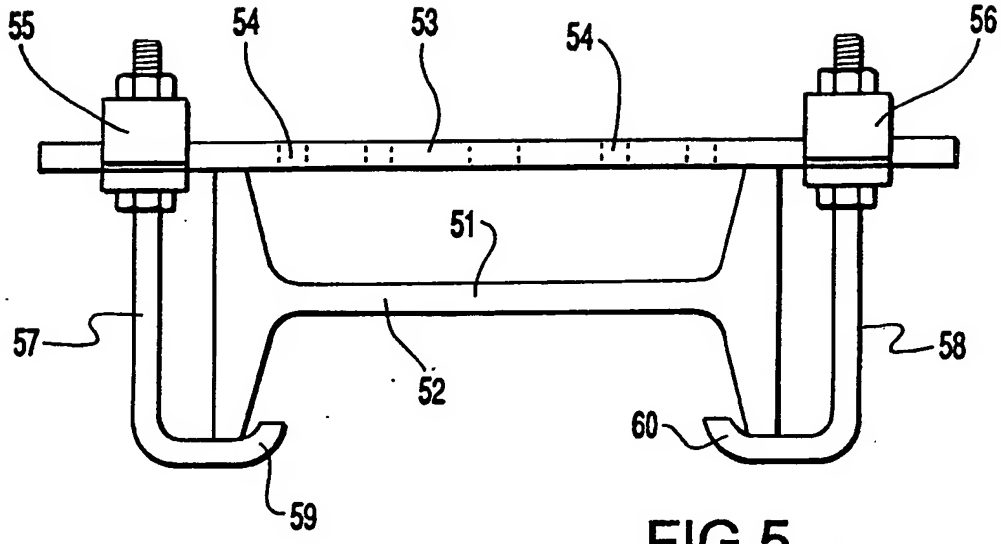

FIG 5

A GUIDE DEVICE FOR A DRILL

The present invention relates generally to a drill guide device, and particularly to such a device suitable for receiving a portable hand drill for guiding it in its motion towards and away from a workpiece for controlling the drill feed motion, and for locating and clamping a workpiece.

Portable hand drills are used extensively for a wide range of drilling operations, and have acquired considerable popularity as a result of their versatility and their portability. They do have a disadvantage, however, in that the precise orientation of the drill bit in relation to the surface of the workpiece to be drilled is usually gauged only subjectively which very often results in the hole being inadvertently formed at an angle to the normal to the surface. In many applications this is tolerable, for example if the workpiece is very thin the inclination may be negligible.

In circumstances where it is necessary to obtain accurate engineering standards and the workpiece itself is relatively transportable, it is possible to make use of a pillar drill to achieve greater accuracy. The pillar drill, however, has a major disadvantage in that it is not portable, and therefore cannot be used on site in any

circumstances remote from the engineering workshop in which the drill is situated. At present, then, it is possible to obtain accurate drilling at a workshop having a pillar drill or inaccurate drilling on site remote from the workshop. A pillar drill attachment for a portable drill is known, but again, this requires a mounting bed and is really a workshop attachment rather than a portable tool.

Another disadvantage of portable hand drilling machines is the fact that the force which can be applied to feed the drill bit is no more than that which can be applied manually by the user. This is usually sufficient only to feed a drill bit of relatively small diameter so that if a larger diameter hole is required this can only be achieved by successive drilling with successively larger drill bits, taking a small amount of material from the perimeter of the hole at each drilling.

The present invention seeks to provide a drill guide device having means for engaging a workpiece so that the precise location and orientation of a hole can be determined with a relatively high degree of accuracy. Embodiments of the present invention can also be made with means for offering the user a considerable mechanical advantage in achieving the feed motion of the drill bit so that a hole of even quite considerable size, say between

half inch and three quarters of an inch, can be drilled into steel at a single pass. It will be appreciated that this is quite impossible using a hand held drilling machine without mechanical advantage since the force which must be exerted is considerably greater than that which can be applied by hand alone.

According to one aspect of the present invention, therefore, there is provided a drill guide device having means for engaging a workpiece and for applying a clamping force thereto as the drill is advanced towards the workpiece along the guide device.

In a preferred embodiment of the invention there is further provided a mechanical linkage between a drill carrier and a drill feed control member, the said linkage providing a mechanical advantage between the movement of the drill feed control member and the movement of the drill.

Although, in strictly rigorous engineering terms, the drill is constituted solely by the drill bit, and the drilling machine, which holds the drill bit, should be identified as such, it has become conventional for a hand held portable drilling machine to be referred to as a drill (whether or not it carries a drill bit at the time) and as used in this specification the term "drill" will be

understood to refer to a drill bit or a drilling machine or a combination comprising a drilling machine and a drill bit as the context demands.

The workpiece engagement means of the drill guide device of the present invention may comprise a clamp device having two jaws with respective coaxially aligned apertures therein to allow the passage of a drill bit therethrough. It will be appreciated that such a clamping device is able only to grip a workpiece adjacent one edge since, in practice, jaws of an extended size capable of clamping a workpiece at a point remote from its edge cannot readily be produced for combination with a hand held drilling machine. Nevertheless, this physical limitation is not a serious disadvantage since many holes must be drilled close to the edge of a workpiece and it is possible to produce an adapter which can be linked to a workpiece of greater area, such as a panel, by means of which the drill guide device of the present invention can be adapted for use even in the centre of a panel of considerable dimensions. A suitable such adapter will be described in more detail hereinbelow and it is to be understood that the combination of a drill guide device and such an adapter is also intended to fall within the terms of the invention defined in the present application.

The drill feed control member and the said workpiece

engaging means are preferably interconnected in such a way that the clamping force exerted by the workpiece engaging member is applied by the actuation of the said drill feed control member. As used in this specification the term "drill feed" will be understood in its engineering context to refer to the advancing motion of a drill as it is moved towards the material being cut by the drill tip cutting edges.

It will be appreciated that, as the drill guide device of the present invention is adapted to receive a portable drill, the workpiece engaging means and a drill carrier of the drill guide device are, therefore, relatively approachable to advance the drill towards the workpiece to effect drilling thereof. In operation of the device, therefore, it may be considered that the workpiece is held stationery while the drill is advanced towards it or, correspondingly, the drill is held stationery while the workpiece is advanced towards it.

In a preferred embodiment of the invention the workpiece-engagement means comprises a clamp having a first jaw mounted on at least one fixed elongate primary guide member along which the said drill carrier is slidable. In the preferred embodiment of the invention there are two such elongate primary guide members and the term "fixed" is intended to define the relative connection between the

first jaw and the guide members neither of which, however, is to be considered as fixed in relation to any other component of the drill or, indeed, with respect to a fixed frame of reference.

The said clamp preferably has a second jaw, movable with respect to the first jaw and mounted on an elongate secondary guide member which is relatively displaceable with respect to the said first jaw of the clamp and, additionally, with respect to the drill carrier.

The drill carrier may be provided with a hand grip for manipulation of the device and, hereinbelow, such a hand grip will be referred to as the first or primary hand grip for reasons which will become apparent during the following description.

The drill carrier and the second jaw of the clamp means are preferably interconnected by a mechanical linkage by which relative movement towards or away from one another can be achieved. The drill feed control member is likewise connected by a second mechanical linkage to the said first mechanical linkage interconnecting the said drill carrier and the said second jaw of the clamp means. Operation of the drill feed control member thus causes relative approach of the two jaws as well as relative approach of the drill to the clamp means comprising the

said two jaws.

In the preferred embodiment of the invention the drill feed control member is a second hand grip attached to a pantograph linkage constituting the said mechanical linkage interconnecting the said feed control member and the said first mechanical linkage.

The said drill carrier may be provided with at least one collar surrounding a primary guide member and mechanically interconnecting the said drill carrier and the said primary guide member or relative sliding movement. The said primary guide member preferably has associated therewith resilient biasing means engageable by the said collar of the drill carrier whereby to urge the drill carrier towards a first or rest position spaced from the workpiece clamping means. In such rest position it is preferred that the jaws of the clamping means are spaced apart from one another.

Such resilient biasing means may, for example, comprise at least one coil spring fixed at one end thereof to the said primary guide member and the other end of which is engageable by the said collar of the said drill carrier.

The drill guide device of the present invention may include means for releasably holding a drilling machine

such as a pistol drill thereto or, alternatively may be provided with means for securely fixing a drilling machine thereto.

Various embodiments of the present invention will now be more particularly described, by way of example, with reference to the accompanying drawings, in which:

Figure 1 is a perspective view of a first embodiment of a drill guide device formed according to the present invention;

Figures 2 and 3 are respectively front and rear perspective views of a second embodiment;

Figure 4 is a rear perspective view of a second embodiment; and

Figure 5 is a schematic sectional view of an adapter device suitable for use in connection with the drill guide device of the present invention.

Referring now to Figure 1 of the drawings, the drill guide device illustrated in Figure 1 is generally indicated with the reference numeral 11 and comprises a drill carrier generally indicated 12, clamp means generally indicated 13 and drill feed control means generally indicated 14 by which a drilling machine (not illustrated) mounted on the drill carrier 12 can be caused to advance towards a workpiece held in the clamp means 13 or, correspondingly,

the workpiece held in the clamp means 13 may be caused to approach a drill mounted in the drill carrier 12. Because it is a portable tool the action generated by actuation of the feed device 14 causes relative approach of the drill carrier 12 and the clamp means 13 or relative separation of these two, rather than movement of one with respect to the other and a fixed frame of reference.

The drill carrier 12 comprises a substantially rectangular elongate drill carrier body 15 having, projecting from one face thereof, a drill carrier mount 16 in the form of a loop welded to one face 17 of the drill carrier body 15. Other attachment or clamping means by which a portable pistol drill may be secured with its axis of rotation parallel to the axis defined by the loop 16 and the face 17 of the drill carrier body 15 may also be provided, but are not shown in the drawing.

The drill carrier body 15 has two pairs of laterally projecting collars, generally indicated 19, 20 at the upper end and 21, 22 at the lower end. The collars 19, 21 projecting from a first side face of the drill carrier body 15 have aligned apertures and the collars 20, 22, which project from an opposite face of the drill carrier body 15 from that from which the collars 19, 21 project, also have aligned apertures. Two main elongate guide members 23, 24 pass through these respective pairs of

aligned apertures so that the drill carrier body 15 is slidable axially of the guide members 23, 24 guided by the collars 19, 20 and 21, 22. Two coil springs 25, 26 surround respective guide members 23, 24 and are secured at their lower ends by removable spring clips 27, 28. At their upper end the coil springs 27, 28 are engaged by tubular sleeves 29, 30 slidable over the elongate primary guide members 23, 24 between the upper ends of the springs 25, 26 and the upper guide collars 19, 20. The motion of the drill carrier body 15 in a first direction along the elongate primary guide members 23, 24 (that is downwardly in the direction viewed in Figure 1) will cause compression of the coil springs 25, 26 which, therefore, bias the drill carrier body 15 upwardly of the guide members 23, 24 towards the position where the collars 19, 20 are close to the upper ends of the guide members 23, 24. A plurality of transverse holes 31, 32 in the elongate guide members 23, 24 allow for the resilient clips 27, 28 to be located at selected positions along the guide members 23, 24 for reasons which will be described in more detail hereinbelow.

At their lower ends the elongate primary guide members, which may be in the form of solid rods, as illustrated, or which may be hollow tubular guides, are fixedly secured, for example as by welding, to an upper jaw 33 of the clamp means 13. The upper jaw 33 has a first aperture 34

therein on one side of the plane defined by the two guide rods 23, 24 and on the other side of this plane is provided with a fixed square-section collar 35 through which passes an elongate square-section secondary guide member 36. This secondary guide member 36 is a sliding fit within the collar 35 and, at its lower end, is fixedly secured to a second jaw 37 of the clamp means 13. The second jaw 37 of the clamp means 13 has a second aperture 38 coaxially aligned with the aperture 34 in the first jaw 33. The two jaws 33, 37 lie parallel to one another so that they can be drawn together with the upper face of the second jaw 37 parallel to and in contact with the lower face of the first jaw 33. As described herein the terms "upper" and "lower" will be understood to refer to the faces of the jaws when the guide device of the invention is in the orientation illustrated in Figure 1. It is to be appreciated, however, that being a portable device it may be used in any orientation so that these faces may, in fact, be vertical or at any angle to the horizontal determined by the inclination of the workpiece on which drilling is to take place in a manner which is described in more detail hereinbelow.

At its upper end the drill carrier body 15 carries a second rectangular collar 39 which is coaxially aligned with the rigid rectangular collar 35 of the first jaw 33 of the clamp means 13 so that the square section secondary

guide member 36 passes therethrough and is a sliding fit therein.

A first hand grip 40 is also fixedly secured to the square section collar 39 and defines a pivot axis for a first pair of second order levers 41, 42 which form part of a pantograph linkage generally indicated 43 and which comprises a plurality of such pairs of levers connected at the free end to a second hand grip 44 pivotally connected to a pair of short links 45, 46 joining the ends of the last pair of second order levers of the pantograph linkage 43 to a central pivot 47 of the hand grip.

The first pair of second order levers 41, 42 are connected at their free end to a linkage comprising two rigid links 48, 49 which are joined together at a pivotal connection 50 to the secondary guide member 36. In use of the drill guide device of the present invention a drilling machine is fitted to the drill carrier body 15 by means of the loops 16 and such other attachments as may be appropriate to the precise nature of the drilling machine itself so that the drill chuck is located between the loop 16 and the first jaw 33 of the clamp means 13 and the drill axis is parallel to the face 17 of the drill carrier body 15 and approximately aligned with the common axis of the two apertures 34, 38 in the first and second jaws 33, 37 of the clamp means 13. The spring clips 27, 28 are

positioned in appropriate apertures 31, 32 so that, at rest, with the coil springs 25, 26 fully relaxed, there is sufficient space for a drill bit to be introduced into the chuck of the drilling machine and fitted in place with the tip of the drill bit spaced from the upper face of the jaw 33.

A workpiece to be drilled is then introduced between the two jaws 33, 37 of the clamp means 13 and its position adjusted until it is aligned with the desired point at which the hole is to be formed in alignment with the drill axis. Then, by grasping the primary hand grip 40 and the secondary hand grip 44 and urging these towards one another the pantograph linkage 43 is caused to collapse placing a tension on the two links 48, 49 and thereby causing a relative approach of the drill carrier body 15 and the second jaw 37 which is drawn towards the first jaw 33 by the movement of the secondary guide member 36 to which the links 48, 49 are attached. When the two jaws 33, 37 meet, with the workpiece between them, and can no longer move in relation to one another, the tension applied by the links, 48, 49 to the secondary guide member 36 is transferred from the second jaw 37 through the workpiece to the first jaw 33 and from this to the primary guide members 23, 24 which are therefore caused to move in relation to the collars 19, 20, 21, 22 of the drill carrier body 15. Alternatively, of course, the relative

approach of the clamp means 13 and the drill carrier body 15 can be considered to comprise a force applied via the collar 39 to the drill carrier body 15 causing it to move down the primary guide members 23, 24 as a result of the relative approach of the pivot 50 to which the links 48, 49 are connected at one end and the pivot (not illustrated) about which the first two links 41, 42 of the pantograph linkage 43 are pivoted. In performing this movement the drill carrier body 15 causes the sleeves 29, 30 to be displaced along the primary guide rods 23, 24 towards the clamp means 13 thereby compressing the 25, 26.

The force which can be exerted between the drill bit and the workpiece clamped between the jaws 33, 37 is considerably in excess of that which could be applied manually by an operator holding a drilling machine because of the considerable mechanical advantage provided by the pantograph linkage 43. When the drill bit has been caused to pierce the workpiece and therefore pass through both apertures 34 and 38 in the jaws 33, 37 the hand grip 44 is released and the springs 25, 26 will cause the drill carrier body 15 to move along the primary guide rods 23, 24 towards the position illustrated in Figure 1 allowing jaws 33, 37 to open after the drill bit has been withdrawn from the workpiece secured between them. This withdrawal can also be encouraged by manually separating the hand grip 40 and 44.

The separation between the jaws 33, 37 determine the thickness of workpiece which can be clamped by the device. This can be made adjustable by providing the pivot 50 with a releasable coupling and the secondary guide member 36 with a number of spaced locations at which the pivot 50 may be secured. In the embodiment of Figures 2 and 3 these locations are in the form of spaced holes for receiving a retractable pin. Referring now to Figures 2 and 3 in more detail, the component parts which are the same or fulfil the same function as corresponding parts in the embodiment of Figure 1 are identified with the same reference numerals.

The basic components of the embodiment of Figures 2 and 3 and its general function, are the same as in the embodiment of Figure 1; this embodiment differs, however, in a number of detail refinements, and only these differences will be described in detail.

First; the fixed pivot 50 is replaced by an adjustable body 150 having two transverse lugs 151, 152 through which pass two pivot pins 153, 154, which separately join the lowermost links 48, 49 to the body 150. The adjustable body 150, itself, has an internal ratchet mechanism (not shown) engageable with holes 155 formed in the secondary guide member 36. The ratchet within the body 150 is lockable by means of a clamp screw 156 turnable by means

of a handwheel 157. This locks the body 150 in its chosen position along the secondary guide member 36, allowing ready adjustment of the rest position of a drill (not shown) mounted on the drill carrier body 15. In this way the limited travel of the drill under the control of the drive handle 44 can be successively extended to allow a deeper hole to be formed in a workpiece, when such is required, than can be formed by a single collapse of the pantograph linkage 43.

The drill carrier body 15 differs from that in the embodiment of Figure 1 by the provision of a clamp loop 116 at a lower end and an end fitting 117 at the upper end.

Finally, the secondary guide member 36 carries an additional clamp device 158 which is usable to hold the two workpiece clamping jaws together to retain a workpiece between them even when the pressure on the handle 44 is released, to allow the successive advancing movements of the body 150 to take place without loosening the grip on the workpiece. The clamp 158 comprises a collar 159 fitted slidably over the secondary guide member 36 and carrying an arm 160 pivotally mounted to turn about a pivot 161. Turning movement of the arm 160 is controlled by a screw clamp 162 which acts both to lock the collar 159 to the secondary guide member 36 and to apply

pressure, by the turning action of the arm 160, to the upper jaw 33 urging it towards the lower jaw 37.

In the embodiment of Figure 4 the mechanical pantograph linkage by which the user can exert a force manually with the mechanical advantage offered by the multiplicity of levers, is replaced by a fluid pressure actuator 165. This may be an hydraulic ram fed from an external source, as shown, or may be an actuator having an integral or separate manually operable pump (not shown) by which the operator may cause the relative displacement of the drill carrier body 15 and the workpiece clamp constituted by the two jaws 33, 37. In the embodiment shown in Figure 4 the adjustment of the springs 25, 26 is achieved by means of an indexed slot 166 having a regular array of index notches 167 into which engages a locating pin 168 carried by a collar (not shown) slidable over a respective primary guide 29, 30. This replaces the spring clip arrangement 27, 28 of the embodiment of Figure 1. Alternatively (although not shown) the actuator 165 may be a pneumatic actuator fed from a compressed air line. Likewise, although described herein with specific reference to its suitability for portable electric drills, the present invention may equally well be used with pneumatic or hydraulic drilling motors.

It will be appreciated that in any of the above-described

embodiments the distance between the secondary guide member 36 at its attachment to the second jaw 37 and the aperture 38 through which the drill bit passes determines the maximum distance from the edge of the workpiece at which a hole can be pierced. If it is desired to produce a hole in the workpiece further from the edge thereof than this distance an attachment such as that illustrated in Figure 2 may be employed. This attachment is designed specifically to allow holes to be drilled in the web 51 of an I-section beam 52 illustrated schematically in Figure 5. This is achieved by means of a drill plate 53 having a plurality of holes 54 drilled at regular intervals and which can be clamped between the jaws 33, 37 of the clamp means 13 in place of a workpiece as described hereinabove. The drill plate 53 is provided with adjustable clamps 55, 56 screwed onto J-shape hook members 57, 58 having hooked ends 59, 60 which can engage over the flanges of an T-beam 52 with appropriate adjustments being made by the clamp members 55, 56 to mount the drill plate 53 on an I-beam of any specific dimensions within the range of adjustments determined by the dimensions of the adapter.

Then, by providing a drill bit of sufficient length and/or adjusting the spring clips 27, 28 or the adjuster pin 168 appropriately, the range of movement available from the tool 11 can be suitably modified so that the drill bit can be caused to pierce the web 51 of the I-beam when the

handles 44, 40 are caused to approach one another.

Other adaptor devices along such lines may be provided to fit the tool of the present invention for drilling holes in panels or other components.

CLAIMS

1. A drill guide device having means for engaging a workpiece and for applying a clamping force thereto as the drill is advanced towards the workpiece along the guide device.

2. A guide device as claimed in Claim 1, in which there is provided a mechanical linkage between a drill carrier and a drill feed control member, the said linkage providing a mechanical advantage between the movement of the drill feed control member and the movement of the drill.

3. A drill guide device as claimed in Claim 1 or Claim 2, in which the workpiece engaging means comprise a clamp device having two jaws with respective coaxially aligned apertures therein to allow the passage of a drill bit therethrough.

4. A drill guide device as claimed in Claim 2 or Claim 3, in which the drill feed control member and the said workpiece engaging means are interconnected such that the clamping force exerted by the said workpiece-engaging means is applied by actuation of the said drill feed control member.

5. A drill guide device as claimed in any preceding claim, in which the workpiece engaging means and a drill carrier of the guide device are relatively approachable to advance the drill towards the workpiece to effect drilling thereof.

6. A drill guide device as claimed in any of Claims 2 to 5, in which the workpiece-engagement means comprises a clamp having a first jaw mounted on fixed elongate primary guide members along which the said drill carrier is slidable.

7. A drill guide device as claimed in Claim 6, in which the said clamp has a second jaw, movable with respect to the first jaw and mounted on an elongate secondary guide member which is relatively displaceable with respect to the said first jaw of the clamp and with respect to the drill carrier.

8. A drill guide device as claimed in any of claims 2 to 7, in which the drill carrier has a hand grip for manipulation of the device.

9. A drill guide device as claimed in Claim 7 or Claim 8, in which the drill carrier and the second jaw of the clamp means are interconnected by a first mechanical linkage.

10. A drill guide device as claimed in Claim 9, in which the drill feed control member is connected by a second mechanical linkage to the said first mechanical linkage interconnecting the said drill carrier and the said second jaw of the clamp means.

11. A drill guide device as claimed in any of Claims 8, 9 or 10, in which the drill feed control member is a second hand grip attached to a pantograph linkage constituting the said mechanical linkage interconnecting the said feed control member and the said first mechanical linkage.

12. A drill guide device as claimed in any of Claims 2 to 11, in which the drill carrier has at least one collar surrounding a primary guide member and mechanically interconnecting the said drill carrier and the said primary guide member for relative sliding movement.

13. A drill guide device as claimed in Claim 12, in which said primary guide member has associated therewith resilient biasing means engageable by the said collar of the drill carrier whereby to urge the drill carrier towards a first or next adjacent position spaced from the workpiece clamping means.

14. A drill guide device as claimed in Claim 13, in which the said resilient biasing means comprise at least one

coil spring fixed at one end thereof to the said primary guide member and the other end of which is engageable by the said collar of the said drill carrier.

15. A drill guide device as claimed in any preceding Claim, in which the drill carrier includes means for releasably holding a drilling machine.

16. A drill guide device as claimed in any of Claims 10 to 15, in which the said mechanical linkage includes adjustment means for adjusting the range of relative movement of the drill carrier member and the said second jaw of the clamp available upon displacement of the second mechanical linkage over its range of movement.

17. A drill guide device as claimed in Claim 16, in which the said adjustment means are lockable to fix the said first mechanical linkage in position with respect to the secondary guide member.

18. A drill guide device as claimed in any of Claims 3 to 17, in which there are further provided means for locking the said two jaws of the clamp device in a selected position to clamp a workpiece therebetween irrespective of the feed force applied to the drill carrier member.

19. A drill guide device as claimed in any of Claims 1 to

8, in which the drill carrier and the second jaw of the clamp means are relatively displaceable under the action of a fluid pressure actuator.

20. A drill guide device substantially as hereinbefore described with reference to, and as shown in, the accompanying drawings.

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